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ABSTRACT

A sample of 358 men and 360 women took the Self-Directed Search (SDS), a vocational guidance tool developed by Holland based on his theory of vocational choice. Holland had found that in the occupational domain the factor loadings on the Realistic, Investigative, Artistic, Social, Enterprising, and Conventional scales fit a hexagonal paradigm where adjacent types usually had similar loadings and distant types usually had divergent loadings. Data from this sample was subjected to factor and configural analysis in an attempt to verify the relationships among Holland's personality types, to clarify the characteristics of each type, and to extend the hexagonal model to new domains of assessment. The results of the analyses offer strong empirical support for the hexagonal arrangement of the personality types, and also support the organization of the SDS and Holland's occupational classification. (Author/DG)

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" A STRUCTURAL ANALYSIS OF HOLLAND'S PERSONALITY TYPES USING FACTOR AND CONFIGURAL ANALYSIS"

BY

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TM 000 693

The Johns Hopkins University

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INTRODUCTORY STATEMENT

The Center for Social Organization of Schools has two primary objectives: to develop a scientific knowledge of how schools affect their students, and to use this knowledge to develop better school practices and organization.

The Center works through five programs to achieve its objectives. The Academic Games program has developed simulation games for use in the classroom, and is studying the processes through which games teach and evaluating the effects of games on student learning. The Social Accounts program is examining how a student's education affects his actual occupational attainment, and how education results in different vocational outcomes for blacks and whites. The Talents and Competencies program is studying the effects of educational experience on a wide range of human talents, competencies and personal dispositions, in order to formulate -- and research -- important educational goals other than traditional academic achievement. The School Organization program is currently concerned with the effects of student participation in social and educational decision making, the structure of competition and cooperation, formal reward systems, ability-grouping in schools, effects of school quality, and applications of expectation theory in the schools. The Careers and Curricula program bases its work upon a theory of career development. It has developed a self-administered vocational guidance device to promote vocational development and to foster satisfying curricular decisions for high school, college, and adult populations.

This report, prepared for the Careers and Curricula program, is a structural analysis of the personality types developed in Holland's theory of vocational choice. The results of the analysis support the organization of Holland's Self-Directed Search, as well as the structure of Holland's Occupational Classification.

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Abstract

A sample of 358 men and 360 women took the Self-Directed Search, a vocational guidance tool developed by Holland based on his theory of vocational choice. Data from the sample were subjected to factor and configural analysis in an attempt to verify the relationships among Holland's personality types, to clarify the characteristics of each type, and to extend Holland's hexagonal model to new domains of assessment.

The results of the analyses offer strong empirical support for the hexagonal arrangement of the personality types, and also support the organization of the SDS and Holland's Occupational Classification.

Introduction

In a theory of vocational choice, Holland has proposed a typology of personality types and model environments (Holland, 1966). The work of Holland and others suggests that the formulations for the personality types have some validity (Holland, 1968; Elton and Rose, 1970; Richards and Seligman, 1968; Walsh and Lacey, 1969; Williams, 1970; Morrow 1970; Kristjanson, 1969).

More recently, Holland, Whitney, Cole, and Richards (1969) have also shown that the relationships (intercorrelations) among the types [as assessed by the Vocational Preference Inventory (VPI)] can be arranged according to a hexagon in which distances between types are inversely proportional to the size of the correlations between them. Cole and Hansen (1971) have also found that this hexagonal model organizes the data from the Strong Vocational Interest Blank, the Minnesota Vocational Interest Inventory, the Kuder Occupational Interest Survey, as well as the VPI. This spatial arrangement facilitates the interpretation of the similarities and differences among types. In addition, the hexagonal model provided a way to create a more useful occupational classification (Holland, Viernstein, Kuo, Karweit, and Blum, 1970, and a way to organize and simplify a self-administered vocational guidance system (Holland, 1970).

The purposes of the present paper are to take advantage of some new data to verify the relationships observed earlier, to clarify the characteristics of each type, and to extend the hexagonal model

to new domains of assessment. More specifically, positive answers were expected for the following questions:

1. If the data from four different domains of assessment are subjected to individual factor analyses, will the same main factors be obtained for each domain? Will the patterns of factor loadings be the same from one analysis to the next? And will types which closely resemble one another have similar loadings on the same factors? Finally, are the main factors bipolar?

2. If we combine data from four different domains--activities, competencies, self-ratings, and occupations--will that data reproduce the hexagonal model obtained earlier from a single domain (occupation)?

Sample and Data

As a part of a college freshman orientation program at a large state university, 358 men and 360 women took the Self-Directed Search (SDS) which contains the scales used for the following analyses. No claim for representativeness of the sample can be made since they were simply the first group of students to go through the orientation program.

The SDS assessment booklet is organized in terms of six personality types. Separate sections for Activities, Competencies, Occupations, and Self-Ratings determine a person's resemblance to each type: Realistic, Investigative, Artistic, Social, Enterprising, and Conventional. The scales and ratings in the assessment booklet include:

Activities: six scales of eleven items each.
Competencies: six scales of eleven items each.
Occupations: six scales of fourteen items each.
Self-Ratings: two sets of six ratings, each rating corresponds to a type.

Table 1 includes the intercorrelations for the 30 scales used in the factor and configural analyses. Correlations for men are shown below the diagonal; those for women appear above the diagonal.

METHODS

Factor Analysis

The intercorrelations among the six scales in each of the four domains were factor analyzed separately using Harman's "minres" solution (Harman, 1967). The word "minres" is a contraction of "minimum residuals" and designates a method of factor analysis involving the minimization of the off-diagonal residuals of a correlation matrix. The objective of this method is to obtain a factor solution which "best" (in a least squares sense) reproduces the observed correlations. This technique has several desirable properties which minimize the subjective elements of factor analysis. Most important, the "minres" solution requires no initial estimate of communalities; they are obtained as a by-product of the method. The investigator need only estimate the number of common factors prior to calculation. In the present study, three-and four-factor solutions were examined for each domain.

Table 1. The Intercorrelations Among the SDS Scales

	Activities						Competencies						Occupations						Self Ratings (1)						Self Ratings (2)					
Activities	Ra	Ia	Aa	Sa	Ea	Ca	Rc	Ic	Ac	Sc	Ec	Cc	Ro	Io	Ao	So	Eo	Co	R1	I1	A1	S1	E1	C1	R2	I2	A2	S2	E2	C2
Ra	--	34	14	00	09	03	65	33	19	04	18	07	38	31	14	08	11	11	47	24	08	-15	-07	-08	37	16	06	05	-02	00
Ia	35	--	10	12	08	07	38	56	09	12	18	00	20	54	04	06	06	22	26	58	-02	-04	-17	-21	16	33	-04	-03	-07	-15
Aa	04	14	--	04	15	-01	08	14	44	18	16	-05	04	08	38	10	06	-07	04	-04	43	03	-01	-13	08	-07	31	06	02	-05
Sa	00	04	15	--	44	13	05	04	13	47	35	10	-12	00	03	37	19	08	-11	01	02	26	21	-03	-06	04	11	31	18	07
Ea	-04	-02	21	55	--	04	08	04	22	46	66	16	00	04	21	28	45	11	06	-06	06	18	46	04	-05	-03	04	27	45	12
Ca	14	09	01	24	21	--	08	08	-05	10	03	38	-01	-03	-14	08	17	43	07	-03	-14	10	09	47	11	18	02	00	17	43
Competencies																														
Rc	73	37	05	-07	-04	02	--	46	26	09	23	18	31	33	06	05	06	14	46	23	05	-09	-07	-09	32	17	07	05	02	-01
Ic	27	53	15	-03	-03	-10	45	--	24	13	20	10	19	42	08	02	00	15	33	49	08	-04	-11	-13	21	36	11	03	-01	-03
Ac	01	09	66	17	25	-05	07	14	--	25	30	09	11	10	50	09	11	-12	09	02	65	11	-02	-13	12	-13	53	27	07	-02
Sc	-08	-05	12	57	54	11	-05	01	28	--	58	20	-08	07	13	39	22	02	05	06	10	44	29	02	06	12	06	46	37	17
Ec	-04	-03	12	35	63	05	10	07	27	55	--	21	06	09	17	25	38	04	12	11	11	26	39	-05	08	08	07	39	44	07
Cc	15	11	05	16	17	46	23	06	14	15	23	--	18	11	02	08	22	22	09	-01	-06	00	11	49	10	08	-01	03	26	53
Occupations																														
Ro	57	32	08	-02	-04	19	51	26	01	-09	-08	17	--	57	42	10	26	20	30	19	05	-18	-14	-10	21	-04	05	-05	01	-08
Io	17	60	17	-02	-02	-05	24	54	12	01	02	09	36	--	36	16	16	21	30	47	04	-08	-19	-13	23	13	01	-07	-02	-04
Ao	-17	-03	63	08	26	-02	-12	-04	61	17	21	05	01	14	--	34	27	-01	10	-05	44	04	-04	-16	12	-16	38	15	03	-07
So	-16	-09	11	46	36	22	-16	-12	13	34	27	19	03	08	25	--	25	14	03	-04	04	33	08	-02	00	05	09	24	13	00
Eo	-02	-03	06	29	51	44	-02	-06	08	30	41	26	16	02	25	36	--	42	05	01	06	07	32	17	09	05	04	10	35	12
Co	05	10	-06	12	15	59	04	-05	-09	03	10	40	31	14	05	31	57	--	12	14	-16	00	09	28	01	25	00	00	21	22
Self Ratings																														
R1	64	26	-02	-14	-07	06	70	35	00	-10	04	11	42	10	-17	-22	-06	04	--	39	05	-04	04	05	55	25	13	00	10	11
I1	25	60	05	-14	-09	-14	39	68	06	-06	02	07	21	56	-07	-19	-09	-02	38	--	02	-01	-15	-11	21	40	01	-03	-05	-02
A1	-07	00	59	02	14	-12	01	11	60	14	14	-06	-07	07	53	05	04	-11	-04	00	--	02	-06	-11	14	-16	46	16	-06	-05
S1	-24	-07	12	33	40	03	-20	-02	15	46	42	07	-16	03	15	40	20	00	-19	-02	13	--	32	08	-02	03	11	39	29	18
E1	-14	-20	-08	32	45	17	-12	-17	05	41	50	12	-09	-19	07	24	47	14	-09	-21	01	37	--	27	00	06	05	31	52	27
C1	-06	-06	-09	16	23	50	-09	-11	-07	19	21	37	02	-13	-01	16	40	42	-02	-15	-04	22	33	--	13	17	03	03	30	74
R2	57	24	-09	-11	-10	10	62	25	-02	-09	01	09	40	07	-21	-16	-04	09	69	26	-11	-14	-02	06	--	24	10	-03	14	13
I2	06	30	-13	-06	-11	13	17	22	-12	-03	01	17	05	11	-13	-06	05	18	13	31	-14	-05	-07	10	17	--	-02	-01	02	10
A2	-08	00	41	04	-06	-13	-06	03	57	10	11	-03	-09	06	41	-01	-04	-12	01	06	43	05	02	-10	-02	-08	--	24	03	09
S2	-10	-13	06	43	34	04	-11	-15	14	55	36	14	-15	-12	07	27	18	01	-15	-14	06	30	25	10	-11	-04	10	--	33	15
E2	-10	-13	-02	35	55	22	-08	-11	02	44	53	22	-10	-12	07	21	48	27	-06	-11	03	36	52	45	-04	-04	-02	33	--	39
C2	-06	-11	-09	19	24	45	-06	-12	-06	22	18	39	-02	-10	-02	16	39	43	-07	-17	-05	15	30	64	01	-05	-05	23	50	--

Note: Correlations below the diagonal are for men (N= 358). Those above the diagonal are for women (N= 360).

Configural Analysis

To determine whether or not the hexagonal model adequately described scale inter-relationships across domains, the 30 X 30 inter-correlation matrices of Table 1 were subjected to a configural analysis procedure described by Cole and Cole (1970). This procedure first locates each of n scale variables in an n-dimensional orthogonal space by the method of principal components. (Here n = 30.) Next, a two-dimensional cartesian plane is located in n-space so that the sum of the squared variable-to-plane perpendicular distances is minimized. In this sense, the projections of the n scales onto the plane represent a "best" two-dimensional characterization of all scale inter-relationships. This analysis was performed separately for men and women.

RESULTS

Number of Common Factors

In factor analytic studies, the number of eigenvalues greater than one is usually taken as an indication of the number of factors to retain for rotation (c.f., Kaiser, 1970). In eight of the ten factor analyses performed in this study, there were three eigenvalues greater than one. The remaining two correlation matrices had two eigenvalues greater than one. They were the scale intercorrelations for males and females in the competencies domain. These results suggest that three factors should be retained.

Another consideration in the retention of common factors is the percentage of total variance accounted for by the factors to be rotated. In general, retained factors should account for a large

portion of the total variance; Morrison (1967) recommends 75 percent or more. In the present study, the percent of variance accounted for does not reach 75 percent until the fourth factor is included.

Table 2

Percent of Variance Accounted for by Four Factors from Ten Correlation Matrices

Scale Content	Men	Women
Activities	82%	80%
Competencies	84	84
Occupations	85	87
Self-Ratings I	82	80
Self-Ratings II	80	81

A third method for determining how many factors to rotate (unique to the minres factor analysis) is a statistical test on the residual correlations (Harman, 1967). After extracting a given number of factors, a chi-square statistic is calculated based upon the amount of residual correlation or unexplained variance. If the chi-square value is large, indicating a low probability that the residual variance is zero, more factors should be retained in the solution. Table 3 gives the chi-square statistics and the corresponding probabilities of occurrence for each of the ten residual correlational matrices. The p values indicate the approximate probability of occurrence for the chi-square value if the true residual variance is zero, and m indicates the number of factors.

In six of ten cases, the p values indicate that a three-factor solution would be adequate whereas in the other four, a four-factor solution is suggested.

Table 3

Chi-Square Test on the Residual Variation For Three-and Four-Factor Solutions from Ten Matrices

	Men			Women		
	X^2	p	m	X^2	p	m
Activities	0.26	.99	3	3.11	.80	3
Competencies	0.98	.85	4	5.17	.55	3
Occupations	2.76	.85	3	0.49	.90	4
Self-Ratings I	1.57	.95	3	5.58	.15	4
Self-Ratings II	4.87	.20	4	0.57	.99	3

$df = \frac{1}{2}[(n - m)^2 + n - m]$
$df = 6$ for $m = 3$; $n = 6$
$df = 3$ for $m = 4$; $n = 6$

n = number of variables
m = number of factors

On the basis of the three methods discussed above, it was decided that the four-factor solution was most meaningful. The proportion of variance accounted for was the major consideration. Seven of the three-factor solutions accounted for only 70% or less of the variance. While the other indices indicate that four factors may be an overestimate, Kaiser (1970) has pointed out that an overestimate of the number of common factors is a conservative error. The factor loading matrices after varimax rotation for each of the four domains are given in Table 4 separately for men and women.

TABLE 4

Factor Loading Matrices from SDS Scales

Separately by Domain

	Males					Females			
ACTIVITIES									
	I	II	III	IV		I	II	III	IV
R	0.43	0.03	0.09	0.02	R	-0.30	0.02	0.02	-0.39
I	0.82	-0.02	-0.02	0.10	I	-0.88	-0.08	0.03	-0.19
A	0.08	-0.15	-0.02	0.66	A	-0.04	-0.07	-0.01	-0.33
S	0.02	-0.63	0.13	0.09	S	-0.08	-0.58	0.08	0.04
E	-0.06	-0.86	0.06	0.14	E	-0.04	-0.78	-0.02	-0.30
C	0.13	-0.19	0.97	-0.02	C	-0.03	-0.08	0.99	0.01
COMPETENCIES									
	I	II	III	IV		I	II	III	IV
R	-0.62	-0.05	0.18	0.04	R	0.58	0.10	0.10	0.12
I	-0.75	0.03	-0.05	-0.16	I	0.76	0.09	0.00	0.07
A	-0.11	-0.14	0.07	-0.44	A	0.20	0.20	0.02	0.96
S	0.09	-0.45	0.05	-0.51	S	0.06	0.64	0.10	0.12
E	-0.07	-0.87	0.11	-0.30	E	0.17	0.86	0.06	0.09
C	-0.11	-0.10	0.90	-0.12	C	-0.11	0.15	0.98	0.02
OCCUPATIONS									
	I	II	III	IV		I	II	III	IV
R	0.48	0.26	0.04	-0.04	R	0.74	-0.09	0.01	0.22
I	0.79	-0.04	-0.07	0.13	I	0.75	-0.15	-0.10	-0.02
A	0.06	0.07	-0.14	0.68	A	0.48	0.16	-0.28	0.38
S	0.02	0.24	-0.75	0.18	S	0.09	-0.08	-0.91	0.14
E	0.01	0.68	-0.20	0.25	E	0.13	-0.36	-0.14	0.59
C	0.21	0.81	-0.16	-0.06	C	0.11	-0.83	-0.05	0.16
SELF RATINGS I									
	I	II	III	IV		I	II	III	IV
R	-0.49	-0.02	-0.22	-0.02	R	0.52	-0.15	0.06	-0.05
I	-0.86	0.25	0.16	-0.01	I	0.84	0.27	-0.04	0.04
A	0.02	0.03	0.07	0.65	A	0.03	0.11	-0.02	-0.99
S	0.07	-0.32	0.77	0.12	S	-0.02	-0.08	-0.49	-0.01
E	0.12	-0.56	0.23	0.01	E	-0.03	-0.51	-0.56	0.01
C	0.03	-0.55	0.06	-0.05	C	-0.00	-0.41	-0.10	0.06
SELF RATINGS II									
R	-0.30	-0.20	0.07	0.09	R	0.30	-0.02	-0.14	-0.02
I	-0.82	-0.00	-0.03	-0.05	I	0.60	0.07	0.08	0.12
A	-0.03	-0.04	-0.12	0.99	A	-0.05	0.04	0.06	-0.49
S	0.04	-0.20	-0.93	0.13	S	-0.09	-0.25	0.63	-0.13
E	-0.03	-0.66	-0.22	-0.02	E	-0.04	-0.59	0.29	0.03
C	-0.12	-0.58	-0.03	0.06	C	-0.00	-0.81	0.06	0.05

Scale Code

R = Realistic
I = Investigative
A = Artistic
S = Social
E = Enterprising
C = Conventional

Interpretation of Factors -- by Domain

The patterns of loadings varied somewhat among the four domains but were similar within a given domain between men and women. The results can be divided into two groups. The first group includes the four loading matrices from the activities and the competencies domains. The second group includes the occupations and the self-rating domains.

Group One. The first factor is clearly identified by the Realistic and Investigative scales. These scales have loadings above .43 on the factor with one exception (R in activities for women) and do not have loadings above .19 on any other factors (with the exception of R in activities for women). In addition, no other scale has a loading on Factor I higher than .20.

The second factor is dominated by the Social and Enterprising variables. These two scales have a clear and simple structure. Their loadings on Factor II are all above .45 with most of them above .60 while their loadings on the other factors are almost all below .30. Finally, no other scale has a loading above .20 on Factor II.

The third factor in the solutions for activities and competencies for both sexes is essentially a one-variable factor with the Conventional scale loading on Factor III above .90.

The last factor in this group is less clearly identified. In two cases (activities-males and competencies-female), it is a single variable factor with the Artistic scale loading above .65. In the other two instances (activities-female and competencies-male) there is a loading on Factor IV above .30 for at least one other scale in addition to Artistic.

Group Two. The second group of factor solutions consists of the factor loading matrices for the occupations and the self-rating domains. From Table 4, it can be seen that on Factor I the Realistic and Investigative scales are again quite factorially distinct. Factor IV, which is dominated by the Artistic scale in each of the six solutions, is a replica of the Factor IV identified earlier. However, the fourth factor in these latter solutions is much more distinct.

The remaining two factors in this group--Factors II and III--are somewhat different from the corresponding factors in the first group in that the Social scale is now loading by itself and the Enterprising and Conventional scales are together. Examining the loadings for these variables, we see again that the simple structure is quite evident.

Summary. There is a marked similarity between the results for men and women on all factors, and among the four domains for two of the four factors. The other two factors have a somewhat different composition in the activity and competency domains than they do in the occupations and self-rating domains, but these differences are not great. None of the factors found in the above analysis were bipolar.

Interpretation of Factors -- Across Domains

Factor analysis is a relative tool, the results of which depend on the number and types of variables in the analysis. In the case of Holland's SDS, the data obtained from the scales within each of four domains are used together to create summary indices. Thus a more accurate factor analytic study would involve a simultaneous

analysis of the 30 scales listed in Table 1.

The first four factors derived from the 30 by 30 correlation matrices for both males and females are given in Table 5. Factor I includes almost all the Realistic and Investigative scales and most loadings are above .50 for both men and women. Further, no other scale loads above .27 on this factor. Factor II has a similar pattern of loadings for the Social and Enterprising scales. Factor III is dominated solely by the Conventional scale from each of the domains with the one exception of the large loading (.58) for the Enterprising scale in occupations for males. The fourth factor is characterized by substantial loadings for the Artistic scale across all four domains. Clearly, the 30 variables taken as an aggregate yield factor loadings which are more consistent across domains than when the domains were analyzed separately. While the separate analyses are useful for examining the validity of Holland's theory, the aggregate solution is a more accurate picture of the structure of the SDS.

It is of interest to note that six factors were extracted from the 30 variable correlation matrix to determine if the six scales each identified a unique factor. The Social and Enterprising scales did not split into two separate factors for either men or women. The same was true for the Realistic and Investigative scales for women only. The R and I scales for men did, however, split into two factors. While a post hoc explanation of the differences between men and women for the R and I scales could be offered, retention of the four-factor solution was considered to be more consistent with the other results.

Table 5
Factor Loading Matrix from SDS Scales
Minres Analysis Across Domains

		MALES						FEMALES					
	VAR.	I	II	III	IV	h^2		VAR.	I	II	III	IV	h^2
A	R	.646	.109	.088	-.079	.44	A	R	-.561	-.010	.040	.166	.34
	I	.599	.060	-.005	.106	.37		I	-.669	-.057	-.126	-.087	.48
	A	.076	-.061	-.004	.744	.56		A	-.080	-.066	-.023	.473	.23
	S	-.042	-.561	.155	.083	.35		S	-.003	-.426	.077	.024	.19
	E	-.023	-.683	.204	.177	.54		E	-.042	-.565	.163	.131	.36
	C	.060	-.077	.686	-.067	.48		C	-.077	-.165	.418	-.139	.23
C	R	.773	.047	.033	-.035	.60	C	R	-.591	-.048	.053	.127	.37
	I	.643	-.010	-.158	.136	.46		I	-.638	-.074	-.058	.043	.42
	A	.091	-.198	-.040	.772	.64		A	-.136	-.224	-.078	.711	.58
	S	-.018	-.739	.042	.128	.56		S	-.078	-.611	.060	.040	.38
	E	.095	-.722	.089	.132	.56		E	-.202	-.727	.005	.118	.58
	C	.202	-.165	.472	.032	.29		C	-.134	-.230	.491	.057	.31
O	R	.553	.148	.266	.038	.40	O	R	-.465	.077	.040	.221	.27
	I	.480	.033	-.024	.231	.29		I	-.659	-.007	-.054	.108	.45
	A	-.119	-.112	.104	.753	.60		A	-.165	-.165	-.099	.629	.46
	S	-.149	-.385	.260	.151	.26		S	-.087	-.433	-.038	.108	.21
	E	-.001	-.400	.585	.094	.51		E	-.146	-.393	.239	.094	.24
	C	.109	-.030	.761	-.026	.59		C	-.270	-.128	.349	-.161	.24
SR I	R	.703	.087	.026	-.104	.51	SR I	R	-.581	.015	.190	.101	.38
	I	.661	.033	-.193	.063	.48		I	-.635	-.006	-.085	-.128	.43
	A	-.021	-.083	-.072	.685	.48		A	-.013	-.040	-.104	.718	.53
	S	-.132	-.569	.013	.107	.35		S	.137	-.514	.020	-.001	.28
	E	-.157	-.579	.227	-.071	.42		E	.186	-.549	.259	-.066	.41
	C	-.075	-.240	.632	-.121	.85		C	.143	.008	.905	-.096	.47
SR II	R	.621	.069	.085	-.170	.27	SR II	R	-.433	.047	.231	.152	.42
	I	.276	.042	.092	-.135	.27		I	-.406	-.069	.163	-.267	.10
	A	-.018	-.062	-.123	.558	.36		A	-.021	-.085	.072	.590	.33
	S	-.136	-.550	.014	.035	.36		S	.067	-.566	-.003	.178	.32
	E	-.088	-.643	.339	-.077	.47		E	.028	-.573	.370	-.016	.54
	C	-.107	-.270	.614	-.116	.68		C	.059	-.133	.812	-.001	.48

h^2 = communality

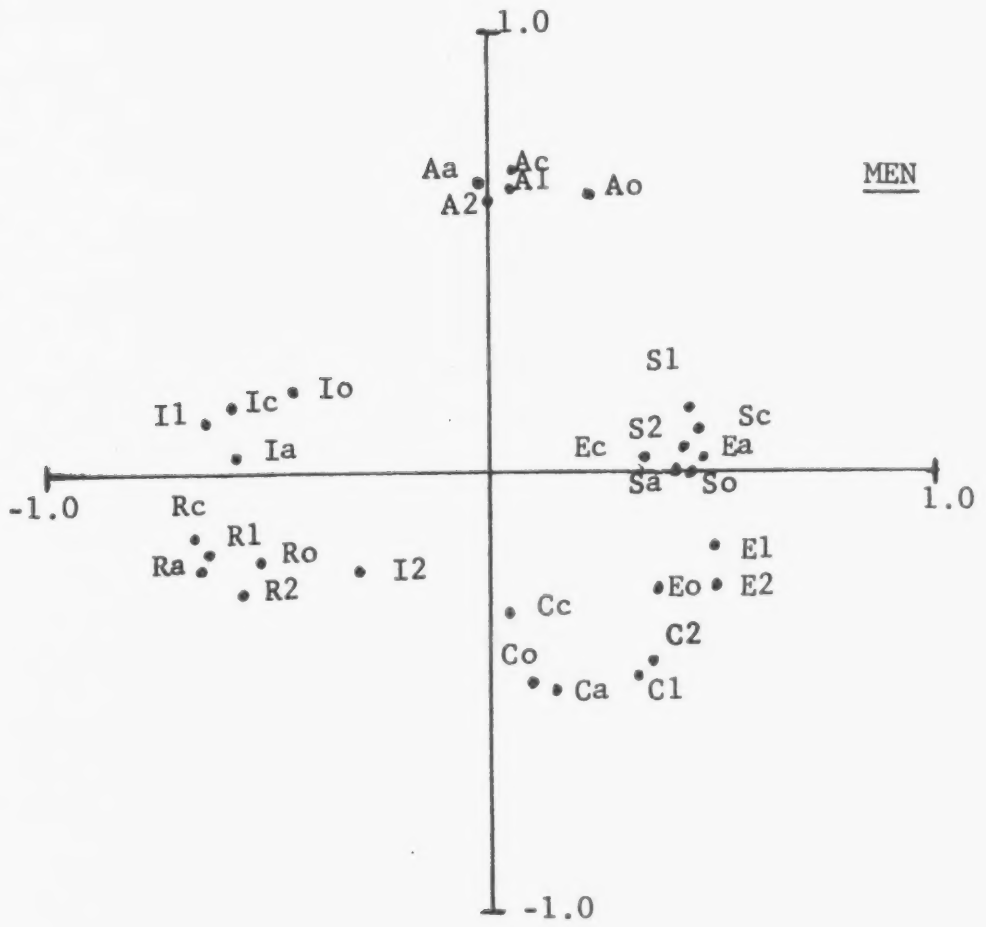
Interpretation of the Configural Analysis

The reduction of information from an n-dimensional space to a two-dimensional space nearly always reults in the loss of information about the original relationships among variables. In the earlier uses of configural analysis (c.f., Cole & Cole, (1970); Cole & Hansen (1971)) this loss of information was not substantial because the plane was used to represent relationships among only 5 or 6 variables. In this study, however, the two dimensions represented by the planes of Figure 1 only accounted for 36% (for men) and 29% (for women) of the variation among the 30 variables. This information loss imposes some limitations on the interpretation of the results of the configural analysis. Within these limitations, however, the results seem instructive.

We see from Figure 1 that the hexagonal model identified in previous research for the occupational scales is approximately replicated across all domains. This configuration was more distinct for men than for women. The coordinates for each of the scales are listed in Table 6.

It is interesting to note that while the factors identified earlier are not bipolar, the scales appear to form bipolar axes when projected into two dimensions. It should be remembered that a large portion of variation exists in dimensions other than those represented on the plane. Consequently, variables whose projections are close together on the plane may be farther apart in n-space. On the horizontal axis, the Realistic and Investigative scales are the bipolar opposites of the Social and Enterprising scales. Along the vertical axis, the Artistic scale is the bipolar opposite of the Conventional scale.

Figure 1. Spatial Configurations
of 30 SDS Scales



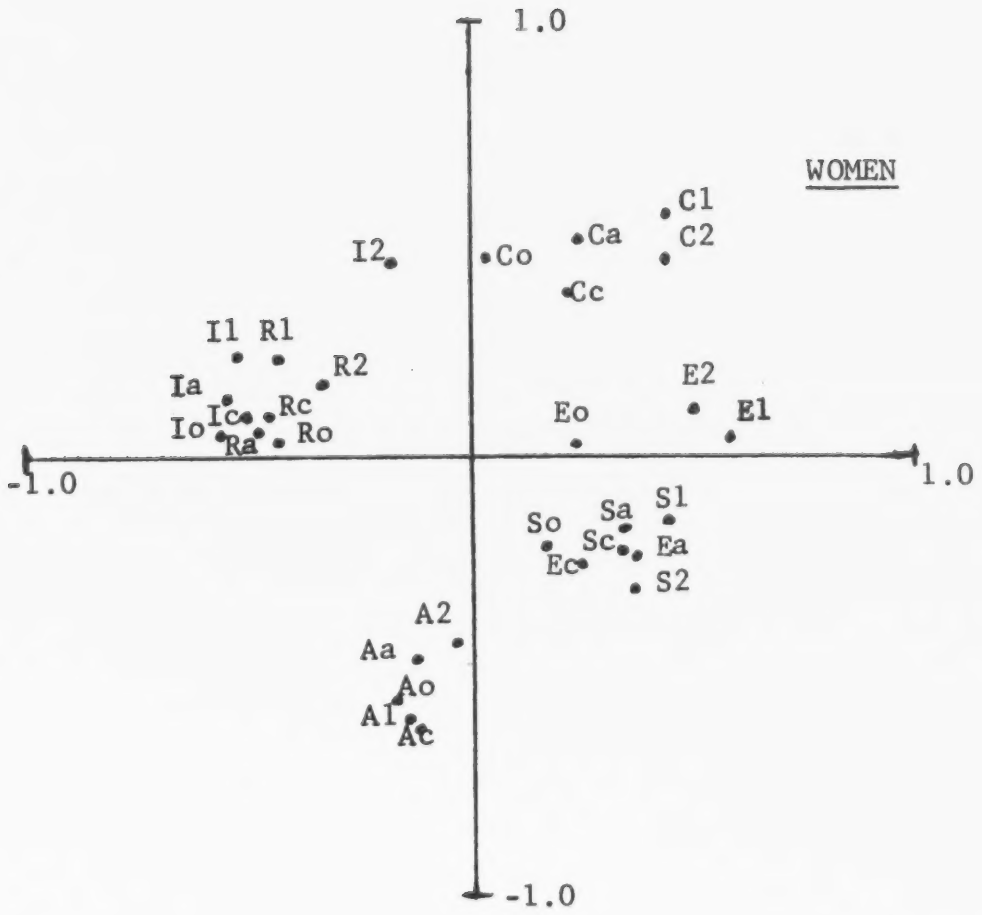


TABLE 6

Planar Coordinates for 30 SDS Scales

from the Configural Analysis

	Men		Women			Men		Women	
Scale	Abscissa	Ordinate	Abscissa	Ordinate	Scale	Abscissa	Ordinate	Absicssa	Ordinate
ACTIVITIES					SELF-RATINGS I				
Ra	-.64	-.21	-.49	.07	R1	-.65	-.19	-.42	.22
Ia	-.58	.04	-.54	.13	I1	-.64	.11	-.51	.23
Aa	-.01	.67	-.11	-.47	A1	.05	.67	-.13	-.60
Sa	.41	.00	.33	-.17	S1	.44	.13	.44	-.14
Ea	.48	.02	.39	-.22	E1	.50	-.17	.58	.04
Ca	.14	-.50	.23	.50	C1	.32	-.47	.44	.57
COMPETENCIES					SELF-RATINGS II				
Rc	-.68	-.14	-.47	.10	R2	-.57	-.28	-.31	.18
Ic	-.59	.16	-.50	.10	I2	-.30	-.21	-.18	.44
Ac	.05	.69	-.11	-.61	A2	.00	.61	-.02	-.41
Sc	.46	.10	.36	-.22	S2	.42	.06	.36	-.30
Ec	.37	.05	.25	-.23	E2	.50	-.25	.50	.11
Cc	.03	-.31	.21	.38	C2	.36	-.44	.43	.46
OCCUPATIONS									
Ro	-.51	-.20	-.46	.03					
Io	-.46	.19	-.56	.07					
Ao	.21	.62	-.16	-.54					
So	.42	.00	.18	-.20					
Eo	.38	-.27	.22	.03					
Co	.09	-.49	.03	.46					

Note: The planar dimensions accounted for 36% of the total variation for men and 29% for women.

The congruence between the configural analysis and the factor analysis is seen in that scales which are opposites on the hexagon (e.g. A and C) never load on the same common factor (see Table 4). Scales close together on the hexagon, however, tend to have loadings on the same factor, and the closer together they are on the hexagon the more consistently they tend to load on the same factor.

SOME IMPLICATIONS

The congruence of results for different item domains suggests that the construct personality type may include a person's activities, competencies, occupations, and self-ratings. That is, personality types can be assessed in one or more of four domains, and Holland's first operational definitions of the types based on the VPI scales probably can be interchanged with definitions based on other domains with only minor errors. This conclusion is also apparent when the original correlational matrix is examined. That matrix indicates that the 30 scales have relatively clear patterns of convergent and discrimanant validity.

The number of types might be reduced to four, since four factors account for more than 80% of the variance within each domain. Because the 6 types are not bipolar, a reduction to three is clearly unwarranted. In contrast, a previous diagonal factor analysis by Richards suggests that each type contributes unique variance independent of the remaining 5 types (Holland, 1968). Perhaps the most tenable conclusion is that the most useful number of types is at least 4 and no more than 6.

The factor loadings reproduce some of the hexagonal relationships observed earlier (Holland, et al. 1969): adjacent types usually have similar loadings and distant types usually have divergent loadings. In addition, when the original correlations in Table 1 are arranged according to the hexagonal model (10 hexagons), the average correlations for the three distances within each hexagon are as predicted 10 of 10 times. The correlations around the perimeter of the hexagon have the highest average; the correlations between every other type are lower; and the three correlations between opposite types have the lowest average correlation. These results and the successful application of the hexagonal model to the Strong, Kuder, MVII, and the ACT Vocational Interest Profile by Cole and Hanson (1971) strongly suggest that the hexagonal arrangement of the personality types has strong empirical support as well as some useful generality.

Finally, the results lend support to the way in which the Self-Directed Search (Holland, 1970), a simulated vocational counseling experience, is structured. That is, the personal assessment uses the scales in the present factor and configural analyses and is arranged in the hexagonal order (RIASEC). Likewise, the arrangement of the occupational classification developed by Holland, Viernstein, Kuo, Karweit, and Blum(1970) is supported by the present study.

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